

4673. '92 ✓
PENNSYLVANIA STATE LIBRARY
DOCUMENTS SECTION

Grooved Axes Of Eastern Pennsylvania

JOHN WITTHOFT AND JAMES MILLER

Reprints in Anthropology
from the
PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION

PA 4673.19/2 no. 87
Wittthoft, John.
Grooved axes of Eastern
Pennsylvania

Digitized by the Internet Archive
in 2017 with funding from

This project is made possible by a grant from the Institute of Museum and Library Services as administered by the Pennsylvania Department of Education through the Office of Commonwealth Libraries

Grooved Axes Of Eastern Pennsylvania

JOHN WITTHOFT AND JAMES MILLER

IF THERE is any specific type of Indian relic which stands out to the collector in eastern Pennsylvania, it is the grooved axe. Each small area has its own particular varieties, generally recognized and distinguished from those of nearby districts by the local collector, but the types and ranges of all these minor distinctions are known only imperfectly and in small segments to a few amateurs. This article is tentatively advanced in the hope that specific local data on local artifact types may be put on record and subjected to criticism and comparison by other students. The available literature on grooved axes neglects many types of interest to any collector, and offers little except obvious ideas and interpretations.

Judging by examination of a large number of collections and from discussions with collectors in many areas, eastern Pennsylvania falls within an area where the use of grooved axes reached a local climax. Axes appear to be more abundant in the drainage areas of the Delaware, Susquehanna, and Potomac than elsewhere in the east, and they are found in bewildering variety. Axes may not have originated in this area, but certain very primitive forms are commonly found in eastern Pennsylvania, and they possibly represent the earliest forms.

Within Pennsylvania, grooved axes show broken and irregular distributions. Axes are almost totally lacking in some sectors, as for example, the Susquehanna Valley in Bradford County from Athens to

Homet's Ferry, although they are abundant in districts immediately up and down stream. Possibly this section of the valley was depopulated during periods when the grooved axe was in use, but this seems unlikely, because no other major artifact type is lacking. The grooved axe is apparently completely absent in Ritchie's Brewerton complex, and some other Late Archaic peoples also seem not to have used this tool.¹ In some other areas they are rare while in others they are especially abundant. Specific axe types show quite local distributions. In areas where the Triassic diabase dikes outcrop, axes are frequently made of this dense, rapidly weathering igneous "ironstone." In nearby counties such axes are rare or unusual. In western Pennsylvania, in the Ohio drainage, hematite axes are rare, but hematite celts moderately common. Hematite tools are unknown in the eastern part of the state, although good local sources for the hardest variety of the mineral are known. A certain shape of three-quarter grooved axe with a slanted groove is well-known as characteristic of the Susquehanna Valley, but rare in other valleys. Grooved adzes and gouges are rare everywhere in our area, but come almost entirely from southern New Jersey and the Schuylkill drainage. Other quite restricted, specialized forms are noted in the following discussion. Other areas have their particular types, and some from the Ohio and

1. William A. Ritchie, *The Pre-Iroquoian Occupations of New York*, Rochester Museum Memoir 1, 1944, pp. 235-267.

the Potomac are poorly known and especially puzzling.

Generally axes are not made from the rocks that outcrop locally but rather from local stream pebbles. The ironstone, argillite, and some shale specimens are exceptions to this rule, but often the stones had been naturally carried for hundreds of miles from their original sources before they were selected by the Indians. This makes any study of stone sources extremely difficult, for the glacial and stream deposits from which the raw material was selected were derived from thousands of different outcrops in Pennsylvania, New York, and Canada. On the Potomac, axes are generally made of a variety of indurated shales and sandstones, found in abundance in the Piedmont. In eastern Pennsylvania the hardest axes were made of highly indurated shales, although some of the coarsely crystalline granitic rocks and fine-grained quartzites used are practically as hard and tough.

Most moderns, accustomed to steel tools, are little impressed with the potentialities of stone tools, and do not realize how tough many of the stones selected for axes were, and how much abrasion and battering some of the Indian's cutting edges would stand. In some cases we are misled by the weathering which stone tools have received since they were used, and we must realize that some of these stones had very different characteristics when they were fresh. Many axes, when freshly broken, show an unweathered interior which is quite different from the surface zone. We rarely find an axe in the condition in which the Indian would have used it, but we generally handle tools which were worn out, or so abused in their last stage of use that the working edge has been nearly destroyed. Weathering also rounds off the cutting edges of all stone tools, including axes, and even arrowheads are vastly modified at the edge by

weathering, since when freshly made they had an edge like broken glass. Finally we must remember that the primitive craftsman was in no hurry, and that he was not interested in forcing his tools to make massive cuts. His carefully prepared and sharpened tools were capable of as good and as precise work as metal tools, and, like other craftsmen, the Indian knew the characteristics of his materials and his tools and could do a job without abusing them.

Experiments by moderns in the use of stone axes in woodcutting show how much such tools could do, but would indicate even more if the tools were freshly made from unweathered stone and sharpened to the standards of the primitive craftsman. This is especially true in the case of Indian axes, judging by some tests made on axes by Witthoft. A series of axes and fragments, of unknown origins and without catalog records, were cut and drilled with machine tools in an attempt to decide which were the toughest and hardest of local axe materials. Drillholes made with a carbide steel bit in the drill press, of large enough diameter so that no amount of force would break the bit, and breakage tests made with a geologist's hammer of vanadium steel, seemed to give the most significant results. In most cases, we found that the outside zone of the axe, generally about an eighth of an inch in thickness, was very easily cut by the carbide bit and easily fractured by crushing and by pecking with a hammer corner. Beneath this zone the majority of the axe fragments could be drilled with some difficulty, and showed more of the fracture characteristics of the fresh materials. Axes of diabase (ironstone from the Triassic intrusions of central Pennsylvania) were as readily drilled as the more easily cut of the granitic rocks, and were invariably more deeply weathered than any other axes of igneous rock. Most of the granitic rocks were

drilled to any depth with no great difficulty, although a great deal of time and force were necessary. Certain stones, especially the shale of pebbles from which axes were made, surprised us, for some of these indurated shales of quite ordinary appearances were impossible to cut deeper than a sixteenth of an inch with the carbide bit, and were as intractable as cobblestone quartzite. Judging by our tests, the hardest and toughest of the axe materials were not the granitic stones but the quartzites, indurated shales, and cobblestones which had lost their granular structure and porosity by having all of their tiny spaces filled with silica. Some of these stones, especially the shales, were also difficult to fracture and tough in respect to factors other than abrasion. Granular materials, on the other hand, pecked and fractured more easily and were torn apart as a result of their granular structure under the bit and other cutting tools. The non-granular stones had greater over-all elasticity, and did not work like either flint or granite. All examples showed a weathered outer zone which had lost most of its strength and toughness, and this zone includes the cutting edge.

There is one peculiar feature about axes that every collector has noted, and that makes it very difficult to determine the age of different axe types. Axes are found in peculiar places and under peculiar circumstances; often several are found in a field that produces no other Indian relics, many are found where there is not so much as a flint chip, and probably the majority of them are not found on productive Indian sites. On the other hand, sites which produce all other relic types in abundance very often have never yielded an axe, or else produce them very rarely. Axes seem to be found without rhyme or reason on almost any type of site, yet they are often missing on sites where one would most expect to find them. They have been found so rare-

ly in excavations that we have almost no local information on them from this source. Witthoft has previously suggested, on the basis of surface collections and midwestern excavation data, that the full-grooved axes are of Early Woodland age and that the three-quarter grooved axes are of Middle Woodland age.² This may be true, but it is still largely unsupported by local evidence. On the other hand, we are quite sure that at least a part of our axes are older than this and pertain to Late Archaic times. There are several reasons for this belief; such axes are frequently found on sites with only Late Archaic material, grooved axes are much too abundant in the areas of Archaic site concentration, and a number of such axes have been excavated from a Kentucky Archaic site.³ Thus we believe that grooved axes have a longer history in Pennsylvania than has been generally supposed, and that many of them are more than three thousand years old.

One curious thing about grooved axes is that they are almost the first artifacts to be carried out of the field, and many sites which once produced them in quantity are now almost cleaned of them. The "tomahawk" is one of the largest and most obvious relics found on our fields, and axes are noticed by people who have never found an arrowhead. A great many of them were

2. John Witthoft, *An Outline of Pennsylvania Indian History*, **Penna. History**, Vol. 16, No. 3, pp. 4-16.

3. William S. Webb, **The Carlson Annis Mound**, Publ. Dept. Anthropology U. of Kentucky, Vol. 4, No. 7, Lexington, 1950, pp. 278, 299, 314.

In some cases we are not sure whether the apparent absence of grooved axes is due to their not having been used, or whether we are merely dealing with sites which did not happen to have them.

Grooved axes are probably a normal part of the Late Archaic cultures of the Southeast, yet in all the excavation reports on shellheaps of the Louderdale Focus and related shellheap complexes of the deep Southeast we can remember only four grooved axes mentioned in passing. It may be that these people did have such axes but had very little occasion to use and lose them on a riverine shellheap, or it may be that the Louderdale people did not have such axes and the few specimens were dropped on these sites by other visitors.

also carried out of fields with stone in older times, and never recognized as artifacts. In earlier days, farmers were much more prone to clear fields of stones by carrying them off to walls and stonepiles and by burying large boulders. Small children generally worked at this job with their elders, picking rocks and piling them on a stoneboat to be hauled away. Many grooved axes were thrown on these loads by children too small to recognize them, and today we frequently find axes and hammerstones in walls and stonepiles. Such accumulations of fieldstone very often were used in roadbuilding, and the Indian axe frequently wound up in the gravel of a township road. Sam Farver's collection includes six axes which were smashed under the sledges of laborers on the Lebanon County roads, and a couple which the men recognized soon enough to divert the hammer stroke. We find fewer axes today than did the old time collector because so many of them have been carried away from our larger sites.

Large series of unfinished axes show clearly the processes by which these tools were made. Generally the aboriginal craftsman started with an elongated river stone, rarely with a broken chunk of rock which he chipped roughly to shape. Using a hammerstone of dense material as a battering tool, the surface of the stone was powdered away to shape the axe blank. Each time the hammer struck the stone, a small pit was produced, much like the "stars" of strain lines produced in glass marbles. Thus the blade was thinned and the whole axe shaped by the usual packing process. Sometimes a certain amount of surplus stone was also chipped away. In some cases, only one end of a pebble was shaped to make an edge; more often the whole area of the stone was shaped and every part of the axe's surface has been formed by pecking. After the axe was

roughly shaped, the groove was battered into the poll of the axe by the same pecking process. Finally the surface was pecked to final shape and the bit of the axe was ground to a thin, sharp edge with a whetstone. Often other parts of the axe were ground and polished, and sometimes every portion of the axe's surface has been smoothed so that almost all traces of pecking are obliterated. Often the groove is highly polished, but this may be due in part to wear from the handle. Some axes were resharpened so many times that only a stump of a blade was left when the tool was finally discarded. Very often an axe is so weathered that all of the old surface is gone, and no traces of pecking or grinding occur. In many cases the polished parts have been more resistant to weathering, probably because the pecked surface layers are filled with tiny cracks and strains, and thus disintegrate more rapidly, while this bruised layer has been already ground off the polished portions. Some axes are so weathered that they are exfoliated and are splitting into sheets which follow the contours of the surface. However, the degree and type of finish are probably important criteria in the classification of axes, where the specimens are well enough preserved. The degree of weathering varies more with the type of stone than with the age of the axe.

Within eastern Pennsylvania three major classes of axes may be distinguished: three-quarter grooved, full grooved, and notched. Three-quarter grooved axes are abundant and show the greatest specialization and the most variety in form. (Plate 2, Nos. 7-17.) These axes are most often highly worked, with all surfaces artificially shaped. The groove has been worked into both faces and one edge of the axe, but does not cross the other edge. The edge not crossed by the groove is often carefully flattened or otherwise modified. Often a

longitudinal groove is worked into this edge, apparently to receive a wedge which tightened the handle.

The axes included in our plates all represent forms which are typical of the area east of the Susquehanna Valley. Types which characterize the Susquehanna, but which are rare east of there, have been omitted in this series. Certain forms, such as the very thin three-quarter grooved specimen on Plate 2, No. 16, are known only from this more easterly area, and in fact the Delaware drainage area is characterized by more commonplace three-quarter grooved forms with a groove at right angles to their long axis. Very thin axes, and others with the body of the axe reduced, leaving raised edges to the groove, are also especially characteristic of the Delaware region. The Susquehanna River Valley is especially noteworthy for three-quarter grooved forms with a very oblique groove, so that the hafted axe would have "hung" strongly toward the user; such axes are extremely rare in the Delaware Valley area. Three-quarter grooved axes are not only more variable than full grooved forms, but greater differences between the forms of different areas are apparent. These distinctions, as well as the better finish of most three-quarter grooved types, strongly suggest that the full grooved forms are the most ancient patterns.

Full grooved axes are equally abundant, and found in some variety. (Plate 1, Nos. 9-13, Plate 2, Nos. 1-6.) Completely symmetrical specimens with all of the faces carefully worked are not so frequent as equally elaborated three-quarter grooved axes. Most specimens retain at least a small portion of the original river-stone surface. In general shape and details of finish, a large part of the full grooved axe series parallels the three-quarter grooved series. However, a number of types of the three-quarter grooved class are not represented

by full grooved types. Many full grooved axes are merely a riverstone with an edge at one end and a groove at the other, but very few three-quarter grooved axes are so little modified.

Pebble-axes (Pl. 1, No. 9) were made from a long, carefully-selected stream stone and modified only by the pecked groove and the pecked and ground cutting edge. These may be one of the earliest grooved axe types, although I suspect that they were also made by people who were used to making more elaborate forms. They are quite uniformly distributed over the state, and we suspect that this very simple variety has as wide a distribution as any other axe form. Up to the present time no example of this type has been excavated from a Pennsylvania site in context, although at the Hixon Site, mentioned in connection with the notched axes, a worn-out pebble axe was found in the plowed soil during excavation.

One very distinctive axe form has much the appearance of the pebble axe, and shows no more grinding as surface finish. This form, as illustrated in Pl. 1, Nos. 10-12, is pecked all over both surfaces and edges, except for a few spots of old pebble surface which sometimes remain. The only grinding is on the bit, and the pecking on all other surfaces was left sharp; this sometimes shows wear, however, and the groove is sometimes polished quite smooth from friction with the handle. These axes are always relatively thick, and sometimes quite long. On typological grounds, this axe type should be one of the very early forms, and its wide distribution would also suggest that it is one of our basic types.

Notched axes are one type of tool which the older collector rarely bothered to pick up, since they were generally very rough and are often badly weathered. Some small sites have almost as many notched axes as they have projectile points, and over the

whole eastern part of the state they are quite common, but most collections include very few of them. In the Susquehanna Valley for fifty miles north of Harrisburg, there are probably twice as many notched axes as there are grooved ones. Our illustrations include a few samples of various types. Commonest are specimens which have been shaped entirely by chipping and pecking, with a sharp chipped edge but without any grinding or polishing. Often on these the pecking is entirely at the notches, and they were pecked only enough to remove the sharp edges in the notch. Others have more pecking in the notches, and some show the barest beginning of a groove. These are not to be confused with unfinished grooved axes, since they show signs of use, and since the groove on the grooved axe was always shaped out before the edge was finished. Still other notched axes were ground to a sharp cutting edge, and other types had some of the surface shaped by pecking and were even rarely ground smooth in the notches. The roughest forms are the commonest ones. Since the notched axes are more crudely made than the grooved ones, and since they show so little use of pecking and grinding as shaping techniques, we believe they were an older type, gradually replaced by full-grooved axes and later by three-quarter grooved forms. Daniel Wilson seems to be the only earlier student to have called attention to the notched types, and, in an important article, he suggested that the notched axe was the ancestor of the grooved axe, a thesis with which we agree.⁴

Notched axes were generally shaped the way that an arrowhead was, by chipping them out of a block or spall of stone, or by

chipping away all of the edges and most of the faces of a flat river pebble. The people who were used to chipping most of their arrowpoints from argillite also chipped axes and choppers from quarry-blocks, and the Archaic people of the lower Susquehanna, at one time when they were making most of their stemmed spearpoints of a local argillite, the "blue ironstone" of the South Mountain, also chipped their axes of the same material, with no use of grinding. Rhyolite notched axes are also known, although these are rare. Choppers were also usually chipped into shape much as one would chip a giant arrowhead or scraper, and in this basic respect the choppers and the notched axes resemble one another closely.

Grooved axes, on the other hand, were not shaped by the flint-chipper's technique, but were pecked, battered, and abraded from river stones or pieces of field stone. The most elemental grooved axes are the pebble-axes, which were made by battering a groove around a river stone of the right shape, and pecking and grinding a cutting edge on one end. Such crude examples are almost always full grooved axes; three-quarter grooved axes were also made from pebbles, but much more of the surface was always worked away. The higher finish of three-quarter grooved axes, their greater variety in shape, material, and type of groove, and their more precise shaping also suggest that they were the latest and most expert type. We have some excavated evidence for this theory from the mid-west, but we still have no proof in our own area that this was the case. In fact, this whole theory of the history of grooved axes is still to be tested by digging in Pennsylvania sites.

Notched axes are not very common in collections, but enough examples are available to indicate the importance of the type. (Plate 1, No. 5-8.) Often they are missing

4. Daniel Wilson, *Stone Cutting Tools*, *The Archaeologist*, Vol. 2, 1895, pp. 179-185.

This article includes the only extensive description of notched axes which I have seen.

in collections because they are rough and unattractive and were not retained for the relic cabinet. We have examined about fifty specimens, and these all conform closely to type. These axes are generally made from a flat slab of hard river stone, often a hard flagstone; a few are argillites. Most are entirely chipped into shape, and the notches are chipped and battered into the edges. Most of this variety show no grinding of the edge, merely a thin coarsely chipped bit. More frequently the stone was shaped by chipping and battering away the edges, and the notches were battered in. The bit rarely shows a minimum of grinding, merely enough to sharpen the edge, and the sides and notches rarely show some shaping by pecking. Sometimes the groove is pecked into the corners, and looks like the beginning of a full groove. Notched axes are conspicuous for the lack of grooves across the faces, the rarity of grinding and polish, and the general roughness and lack of finish of the surfaces. A single specimen with two sets of notches, comparable to a double-grooved axe, in the Pennsylvania State Museum collections, is not cataloged and is of unknown origin; it indicates the existence of another rare type of notched axe, however.

The largest notched axe seen and the only one excavated from sub-plow contexts within the state is an example, thirteen and a half inches long, dug from the Vernon Hixon Site, Locust Grove, Bainbridge, Lancaster County, by Witthoft in May, 1951. This site was the location of the Conoy Town of 1718-1742, and in our excavations here we found pits and graves of this Colonial complex and much earlier pits of an Archaic complex in which these axes are apparently included. The earlier component was found in broad hemispherical pits which were almost completely re-consolidated. These pits contained no pottery, and practically the only things found

in them were chips and long, straight-tanged projectile points, all of a coarse local argillite from the South Mountain which is locally called "blue ironstone." The people of this complex used this stone to the almost complete exclusion of any other material, judging by this and by a few other sites of the same type known through surface survey collections. This complex is poorly known, but is apparently one of our very early and simple lithic industries which used stones other than flint. This particular complex is peculiar in that so few sites are yet known, they are in such a small area, and the source of argillite was very restricted. As part of this complex at the Hixon Site, we found one adze or chopper, without polish, and two notched axes, including the very large one already mentioned. Like the argillite complexes of the Delaware Valley, this culture is interesting because large tools, such as these axes, are made of the same stone that the spear-points were chipped from, and represent the same technique, with no use of pecking and grinding.

One other tool class should be mentioned here, as it was probably the ancestor of the axe, the adze, the celt, and other chopping tools. This is the chopper, frequent on many sites but generally neglected as a specimen by the older collector. (Plate 1, Nos. 1-4.) Choppers are rough rectangular, oval, trianguloid, or slightly stemmed chipped tools, generally about the size of a man's hand, although frequently smaller. They are generally made of hard shale, quartzite, rhyolite, argillite, and other coarse stones, but occasionally they occur in jasper or chert. They are roughly chipped to shape on both faces, and often show a thick, blunt edge or end which was not worked as a cutting edge. Generally, at least one edge or end is thinned a bit, and is badly battered and chipped back from usage. Most of such tools show

use along a long edge, probably as a hand cutting tool or cleaver, but some were used on the ends, and their shapes often suggest that they were hafted. Some show slight suggestions of notches; others are slightly contracted at one end to form a stem.

The four choppers illustrated in no way suggest the great variety in shapes, materials, and technology of the types found in the Northeast, and are included because of their relevance to the axe problem rather than to show any range of chopper forms. Choppers are very important artifacts in this area, and there is a great concentration of them in Pennsylvania, as in New York and New Jersey. They are decidedly unusual in many other areas. While our overall knowledge of North American archeology is still too scant even to discuss the distribution of choppers as such, we have almost no knowledge of them in the Southeast, or indeed in Virginia, and they seem likewise to be absent in much of the Mississippi Valley area. The archeology of Kentucky, for example, is quite well-known, yet chopper types are missing from the reported series of artifacts known from Late Archaic cultures of that area.⁵ How much of this is due to real difference between regions and how much may be blamed on poor collecting and inadequate survey work and surface hunting by professionals we cannot say, but the distribution and typology of chopper forms of all types are problems about which we know very little. These problems are important because there is some evidence that choppers may be among the oldest tool types in the Americas, although they are missing from the Folsom and related cultures, and because they may have been ancestral to all

of our axe, celt, and adze forms.

It should be particularly emphasized that choppers were not hoes or digging tools, since they are found in cultures far too ancient for agriculture, and since their edges show battering from use and also sometimes show the type of wear developed on stone tools by wood working rather than by soil friction. Most of them seem to have been cleavers and rough cutting tools held in the hand, but we are sure that at least some of them were hafted. We have no way of guessing how many of the plain forms without notching or stem constriction were hafted. Some of them, with use signs on all edges, and of certain peculiar shapes, were certainly not hafted, but, again, we have no way of knowing how many were used in the hand. Probably both hafted and hand-held choppers were used for woodworking, but both types of tools must also have been very useful in the butchering of large game.

Choppers occur in large numbers and great variety on Archaic sites of all types, and they include oval and round blades of large size, oval cleavers, pointed chopping tools, rectangles with a sharp edge or a sharp end, and stemmed hoe-like tools with a sharp blade. Generally they are large, thick, and rudely chipped, but a few are of fine workmanship. The majority of them are of rough stones, such as argillite, rhyolite, quartzite, flagstone, and shale, but some were made of jasper and flints. A single specimen, which is illustrated (Pl. 1, No. 4) was not chipped to shape but was made from a cobblestone and was pecked and ground like an axe. These choppers seem to be older than the oldest axe types, and very possibly they were the tool that gave rise to the axe, since some of them were used on the end and since some of the long ones look so much like notched axes. Some earlier archeologists considered these choppers to be of vast antiquity, and

5. Wm. S. Webb, *The Carlson Annis Mound*, "hoes and stone discs," pp. 313-315, 317, 276.

It must be noted here that the tools Webb calls choppers in this and other reports are very different from ours, and represent small chipped flint cutting-tools, blunts, and scrapers.

thought they were to be compared with the early Paleolithic handaxes of Europe. Charles C. Abbott's alleged paleolithic implements, as preserved in the collections of the University Museum, Philadelphia, include a number of these rough stone tools from the Delaware Valley. We now feel sure that they were not a pre-Indian tool, but were a part of the cultures of the Early and Late Archaic Periods; some of them must be more than five thousand years old, but they were still made by the same people who chipped so many of the arrowheads we find. It is possible that some of them are even older than the cultures to which we ascribe them.

The choppers and axes seem to form a continuous series, with no sharp breaks but with occasional intermediary specimens. Some chipped notched axes are so slightly notched that they might be considered choppers. Some notched axes show a slight extension of the notch onto the flat face. Some full grooved axes have only the shallowest trace of a groove across the faces. A few grooved axes have a groove which almost encircles the axe but is absent in the middle of one edge. Apparently the choppers and axes form a continuous evolutionary series. Even though these developments may not have taken place in this area first, the same general trends might be repeated in this and other areas of secondary influence.

The great variety in specific details of axe form, in the shape and placement of the groove, the shape of the bit, the balance, and the weight indicate that these tools represent strong differences in usage, in motor habit. The full grooved axe with the weight balanced almost exactly on each side of the handle would work very differently in the hand than one of the forms with the groove at the very butt; the difference would be as great as that between a double-bitted steel axe and a broad axe.

In the same way, the diagonally-grooved types of the Susquehanna Valley, with their "hung" blades, would require different chopping stance and motion than would one grooved directly across. The first must have handled somewhat like the small incurved woodchopper's axe of medieval Europe, while the other would behave somewhat like the "American axe" of the 1820 frontier. Any axeman realizes that the stance and motions he uses are almost second nature to him, and that differences in axe shapes as basic as these imply very different work habits. Modern Indians in the American Arctic handle an axe very differently than does a white man, and it would seem that equally strong differences could have been seen between the chopping practices of some of the Indians who made these stone axes. As is now obvious, we consider these interesting tools as the usual workaday axes of ancient Indians, as the nearest ancient equivalent of our modern woodsman's axe. As such they did heavy duty in cutting up and shaping wood, but were probably also used for other jobs. The most important of their other functions was probably the butchering of large game, since a stone axe would probably be almost as useful as a steel one in cutting up a deer carcass.

This set of notes has dealt with a large and important set of tool types in very brief fashion, as an introductory discussion rather than as any final set of descriptions. Many important forms are not mentioned here at all, because of limitations in space, knowledge, and the area we are dealing with. In the text we have emphasized the connecting links between different types, and have tried to show how the major forms seem to be part of one natural series rather than disconnected fragments. In the plates, however, we have tried to illustrate typical forms and have deliberately left out the intergrades, since the inter-

mediary forms are not too common and are confusing in a picture series. We have also, to save space, not included any illustrations of large specimens. While we mention polished notched axes, for example, they are rare enough so that we do not have a good, documented specimen available for illustration. We hope that in the future our literature may more emphasize the types and varieties of choppers and axes, as also of other tool series, and that we may later approach a more detailed study of the minor types of this and other areas on a more exact basis.

EXPLANATION OF PLATES

Plate I

1. Chopper, used mainly at lower end, chipped from a thin, flat pebble of hard, gritty Martinsburg Shale; dark zones are places where the outer rind of the pebble has been chipped through and shows in section. From the Gingrich Site, L^e3, South Londonderry Twp., Lebanon Co.; which is located on the Hummelstown Sheet, 1892 Survey, 12 1/16" from the left printed sheet margin and 1 11/16" from the bottom printed margin. This site is a fairly large, concentrated Late Archaic site with some slight evidence of later occupation, but almost no trace of Early Archaic use. Specimens 4 and 8 of this plate come from the same site.
- 2,3. Choppers made from pebbles of sandy shale; 2 appears to be a gritty piece of Rose Hill Shale, and 3 the Tuscarora Sandstone. These pebbles were shaped to a cutting edge at the lower end only, and both show wear and battering from use at this tip; No. 3 shows a very questionable suggestion of grinding at this edge. Both were finished tools which were used very hard and have been deeply weathered since, and were not unfinished axes.

From a small hilltop site, L^e82, in northern Lebanon County, which is located on the Hummelstown Sheet, 6 11/16" from the left printed edge of the map and 10 1/8" from the bottom printed margin line. Specimens 5 and 6 on this plate come from the same site. This site is peculiar, since it has produced more than a dozen of these rough, deeply weathered choppers and notched axes, but has very few chips and other debris and has yielded less than ten projectile points, all of Late Archaic shapes.

4. A unique chopper form from the Gingrich Site (see note for specimen 1). This was made from a wedge-shaped quartzite cobblestone, and the thinner end was pecked and ground to a thin cutting edge, now dulled from use. The top end is thick and is in no way adapted to grooving, but fits the hand very well in hand-axe fashion. The bit was finished and used, and the top shows some battering from use as a hammer. The whole specimen is somewhat adze-shaped rather than symmetrical, and is not like any other specimen we have seen; it most resembles the chipped pebble choppers like specimens 2 and 3, but was made by a very different technique.
5. Pick-shaped notched axe of the local Tuscarora Sandstone, from the same site as numbers 2, 3, and 6. This stone, locally found as the front of the Blue Mountain, is the local Shawangunk Grit, and is the toughest and hardest sandstone with which we are familiar. It was frequently used for axes where easily available, and such tools are usually markedly weathered as is this example. This axe shows no trace of grinding or polishing, and the bit is battered from use.
6. Notched shale axe with narrow bit,

- same site. This axe was apparently chipped from a piece of float from the mountain slope rather than a pebble, and is deeply rotted although the surface is not weathered away.
7. A notched axe of hard, indurated shale found by Max Schrabisch on a site just below the mouth of Lackawaxen Creek, Pike County, described in his book, *Archeology of the Delaware River Valley*, Publ. Penna. Hist. Comm., Vol. 1, Harrisburg, 1930, p. 96, 119. This axe shows no grinding, although there are traces of pecking and the bit shows wear from use; this wear is not soil polish such as developed on hoes.
 8. Notched axe chipped from an extremely hard indurated shale pebble, Gingrich Site (see note on No. 1). This axe shows strong wear, but no soil polish, at the bit, and some wear from a haft at the edges of the notches.
 9. Full grooved pebble axe, pecked from a long pebble of very hard shale, with shaped and used, but not resharpened, edge, and battering from use as a hammer at the top. This is the most elemental form of grooved axe shaped by pecking and grinding.
 10. Full grooved axe pecked to shape and worked on all surfaces, with the only grinding and polish at the cutting edge. The lack of wear and battering on this axe and the small amount of grinding at the bit indicate that it was not used for long after manufacture, and was lost before it became necessary to resharpen edge.
 11. Full grooved axe of the same type, showing overall wear and some battering from use, but with grinding only at the cutting edge. The bit of this axe was resharpened several times before the tool was lost, but not enough to shorten this axe appreciably.
 12. Full grooved axe of the same type, also pecked to form on all surfaces, with shortened and thickened edge from re-sharpening and with some battering and wear from use. The groove is smoothed somewhat from friction with the haft. This axe was found by Haldimand O'Connor in 1893 in the stiff gumbo layer beneath the sandy alluvial mass of Haldimand's Island at the mouth of the Juniata, Dauphin County, and the surface of the axe is still filmed with this tough impervious clay and the pecked spots filled with it. This gumbo underlies the Susquehanna floodplain at several other islands and at several points along the shore in the lower Susquehanna, and lies directly above a bed of cobbles and river stone. Artifacts have been found in and beneath this gumbo at other locations also. This axe, never before illustrated, was the subject of a short notice in *Science*, Vol. 22, 1893, p. 249, by Harvey B. Bashore, the text of which follows:

A GROOVED AXE IN A STRANGE PLACE

Some months since while making observations with Mr. Haldeman O'Connor, of Harrisburg, on an island in the Susquehanna, not far from the city, we came across a perpendicular exposure of a clay bed, from the face of which several feet of earth had been removed by a recent flood. Several boulders were imbedded in its face and one of them *eight feet from the top*, on account of its peculiar shape, attracted attention, and on removal proved to be a grooved axe, well made of a heavy, close-grained sandstone, about six and a half inches wide, having a good cutting edge and a perfect groove—somewhat weathered but not differing in any particular from the many found on the surface. The bed in which the implement was found is a compact clay, the lowest and the last of the terrace deposits of the valley and consequently, geologically speaking, comparatively recent.

Any method, save one, to account for the presence of the axe in this

position, was of no avail. The clay bed seemed to be unquestionably undisturbed, and no theory of tap roots nor upturning of trees would explain it. Did the axe find this resting place—eight feet below the surface—during the deposit of the bed? If it did, its maker, whoever he was, must have lived about the same time,—some thousands of years ago, when the last of the prehistoric floods swept down this old valley, and the origin of Neolithic man, if such he was, must be placed at an early date.

Harvey B. Bashore
West Fairview, Pa., Oct. 1

13. An unfinished axe, the blank form for a more elaborate axe type than any illustrated on this plate. A piece of river stone, in this case a shale pebble, has been chipped roughly to the final shape and almost all of the original pebble surface removed. Then big irregularities have been leveled off by pecking, but no attempt has been made to peck the surfaces to their final contour. Study of large series of unfinished axes indicates that this specimen was ready to have the groove pecked in. After the groove was finished, the edge would have been roughly pecked to bevel, then all the other surfaces of the axe pecked to final shape and the surfaces finished, and finally the cutting edge ground smooth and sharp. This seems to have

been the sequence of procedures for most of the conventional types of full and three-quarter grooved axes, even where a part of the pebbled surface was retained by the finished axe.

1-6, 8. Collection of Sam Farver, Palmyra, Pa.

7, 12. Collection of Pennsylvania State Museum.

9-11, 13. Collection of James S. Miller, Allentown, Pa.

Plate 2

These axes are selected from the Lehigh County collection of James Miller to show range of typical eastern Pennsylvania forms. No. 1 is a double grooved form on which the lower groove is better defined than the upper one. No. 6 has a narrow lower groove which seems to have been added to replace the earlier, upper groove after breakage. No. 7 has a wide groove which is really double, with some trace of an elevation in the center. These three are variants of the more ordinary double-grooved forms with two distinct grooves, as found on both full grooved and three-quarter grooved axes; the plain double grooved forms are not illustrated. No. 5, with raised ridges along the groove, is an extreme example with highly elevated ridges. The other specimens are good examples of the usual eastern Pennsylvania types.



Plate 1—Choppers and Axes



Plate 2—Grooved Axes